NASA SBIR/STTR Technologies

H5.02-9227 - Metallic Joining to Advanced Ceramic Composites

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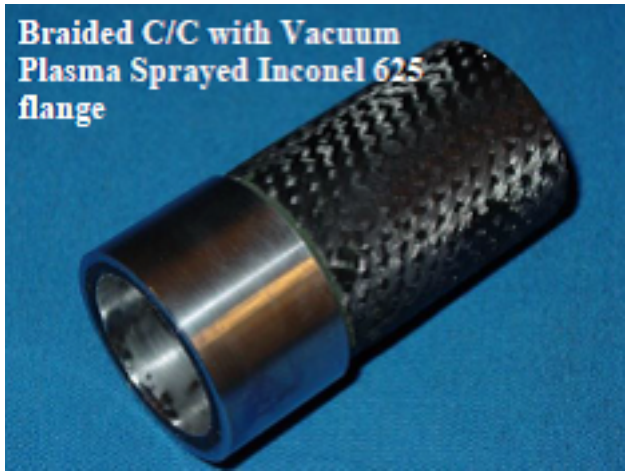
Identification and Significance of Innovation

Advanced ceramic composites are state-of-the-art for high specific strength and temperature capabilities in propulsion components. Advanced ceramic composite components need to be joined with metallic components in such a way that their capabilities are not diminished. Joining techniques are needed for the joining of components such as pintles and composite liners. Current methods involve mechanical fastening and the use of adhesives to join the composite to the metallic structure. Mechanical bonding is not an ideal solution since it causes stress concentrations, and continuous fibers are destroyed by thru holes and threads. Adhesives are of concern because of their lower temperature capabilities. During this investigation, techniques will be developed that will enable deposition of well-adhered Inconel 718 deposits to 4D carbon-carbon/silicon carbide pintles for structural qualification tests.



Estimated TRL at beginning and end of contract: (Begin: 2 End: 4)

Technical Objectives and Work Plan

- Develop a high temperature joining technique suitable for joining advanced ceramic 4D carbon-carbon/silicon carbide composite pintles to Inconel 718 or 625 structures.
- Evaluate the Vacuum Plasma Spray and High Pressure Cold Spray deposition of the Inconel 718 or 625 extension to carbon-carbon/SiC samples using various characterization techniques.
- Determine the need for diffusion barriers to prevent intermetallic formation at the interface between the carbon-carbon/silicon carbide and Inconel by producing samples for heat treating and conducting microscopic characterization
- Produce Joined Composite/Metallic Pintle Assemblies for Structural Qualification Pull Tensile Testing and Compression Testing.
- Develop design(s) for subcomponent hot fire testing in Phase II.

NASA Applications

Plasma's targeted NASA application is for the Orion ACM program and launch abort systems for current and future missions. Other NASA applications include in-space propulsion components for attitude control, orbit maintenance, repositioning of satellites/spacecraft, reaction control systems, and descent/ascent engines, nuclear power/propulsion, reusable launch vehicle propulsion applications.

Non-NASA Applications

Government and commercial entities use advanced high-temperature materials for the following applications: coatings, defense, material R&D, nuclear power, aerospace, propulsion, automotive, electronics, crystal growth, and medical. Plasma's commercial applications include joining composites to metals for thermal protection systems, rocket nozzles, heat pipes, and propulsion subcomponents.

Firm Contacts

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